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Application of comminution machines to enhance the anaerobic biodegradability of ensiled meadow grass

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Anaerobic digestion (AD) is one of the most widespread renewable energy technologies in Denmark and subsequently is of primary interest. During AD, biogas is produced by the utilization of a variety of organic substrates. Recently, lignocellulosic substrates from grasslands, as meadow grass, are considered to be an alternative option to feed the biogas plants, as they pose numerous advantages (Tsapekos et al., 2015). However, for a feasible AD, an efficient pretreatment method is required prior to the addition of biomass into the biogas plant feeding tank. Thus, comminution of meadow grass can efficiently increase the access of the microbial community into the degradable cellulose and hemicellulose.

The present study aims to elucidate the efficiency of various mechanical comminution machines to increase the digestibility of ensiled meadow grass. Hence, batch experiments were conducted. The methane potential of the substrates was defined in triplicates, under thermophilic conditions and based on the biochemical methane potential (BMP) protocol (Angelidaki et al., 2009). More specifically, the impact of the comminution machines was examined through two experimental tests. During the first test, three different comminution machines were loaded with the same grass amount and subsequently, their effect on the biomethanation process was examined. Concerning the second test, the effect of different grass load was examined only in the most promising comminution machine, according to the results obtained from the first BMP test.

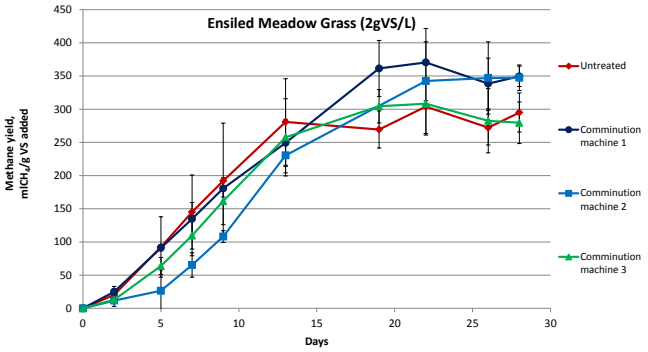

Figure 1. Accumulated methane production

The results showed that the different comminution machines enhanced the biodegradability in significantly different levels ($p < 0.05$) (Fig. 1). The highest methane production increase was appeared to be more than 30% compared to the untreated substrates. Moreover, the highest methane production was revealed when the lowest amount of biomass was processed by the most efficient machine.

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